operation, liquid **919** flows through wicking region **925** to inlet **916**, and through inlet **916** into process microchannel **910**, as indicated by arrow **926**. Heat exchange fluid flows through heat exchange channels **930** and **940** in a direction that is crosscurrent relative to the flow of liquid through the wicking region **925**. Part or all of the liquid **919**, which is in the form of bottoms product B, may flow through outlet **912**, as indicated by arrow **913**. The remainder of the bottoms product B may be vaporized. The vapor **918** flows through process microchannel **910** in the direction indicated by arrow **915** and out of process microchannel **910** through outlet **914**.

[**0145**] The microchannel condenser and microchannel reboiler as components of the inventive microchannel distillation unit can be integrated into the manifolds (header and footer) of the microchannels and liquid channels. An example of manifolding with an integrated microchannel reboiler is shown in **FIGS. 35-37**. The liquid from the last section of the liquid channel (stream **636** in **FIG. 19**) flows into the footer/reboiler section at the unit end and is heated by the heat exchange channels **856** and **858**. Vapor is formed and flows upwards, as indicated by arrow **874**, back into the microchannels via buoyancy. Part of the liquid is drained through the common outlet **862** at the bottom as the bottoms product so that a splitting of boil-up ratio can be controlled by the flow conditions and configuration of the microchannel reboiler. Another example is illustrated in **FIGS. 38-40** where the common outlet of the process channels' footer is located at the side. To prevent carryover of the vapor by the liquid to be drained as product, an extruded edge may be made at the end of each horizontal separation wall. As the heat transfer area is different from channel to channel in a single layer of the unit, the duty of the reboiler microchannel may have to be different. For example, the duty in heat exchange channel **940**A may have to be higher than in channel **940**B, as horizontal channel **940**A is shorter than **940**B. Control of the duty in an individual microchannel reboiler heat exchange channel can be made by changing flowrate, inlet temperature and/or pressure.

[**0146**] The manifold (header) may be located at the end of the unit (**FIGS. 32-34**) where vapor is cooled and partly condensed by the integrated microchannel condenser. The condensation occurs on the wicking structure surface as heat is removed from the wick by the integrated condenser. The condensate may be enriched in the less volatile component and is sucked in by the wicking structure and transported along the liquid channel. The uncondensed vapor leaves the outlet of the manifold so that a reflux is realized. The reflux ratio can be controlled by controlling the duty of the microchannel condenser.

[**0147**] Each of the process microchannels (e.g., process microchannels **410**, **610**, etc.) may have a cross section that has any configuration, for example, square, rectangular, circular, oval, trapezoidal, etc. Each of these process microchannels has at least one internal dimension of height or width of up to about 10 mm, and in one embodiment from about 0.05 to about 10 mm, and in one embodiment about 0.001 to about 5 mm, and in one embodiment about 0.05 to about 2 mm, and in one embodiment about 0.05 to about 1.5 mm, and in one embodiment about 0.05 to about 1 mm, and in one embodiment about 0.05 to about 0.5 mm. The other internal dimension of height or width may be of any value, for example, it may range from about 0.01 cm to about 10 cm, and in one embodiment from about 0.01 to about 1 cm, and in one embodiment from about 0.1 to about 1 cm. The length of each of the process microchannels may be of any value, for example, it may range from about 1 to about 200 cm, and in one embodiment about 1 to about 50 cm, and in one embodiment about 2 to about 10 cm.

[**0148**] The height of each microchannel distillation section (e.g., microchannel distillation sections **220**, **450**, **670**, etc.) may be in the range from about 0.1 to about 1000 mm, and in one embodiment from about 1 to about 100 mm.

[**0149**] The height of each of the microchannel distillation sections **510** and **510***a* for microchannel distillation unit **500** from one vapor inlet/outlet to the next, for example, from inlet/outlet **550** to inlet/outlet **552**, may be in the range from about 0.1 to about 1000 mm, and in one embodiment about 1 to about 100 mm.

[**0150**] The interior walls (e.g., **451** and **671**) of the process microchannel (e.g., **410** and **610**) may be formed of a material that is suitable for establishing a wetted wall. These materials enhance the adherence of the liquid phase to it as the liquid flows along the interior wall as a thin film. Examples of useful materials include steel (e.g., carbon steel, and the like); monel; inconel; aluminum; titanium; nickel; platinum; rhodium; copper; chromium; brass; alloys of any of the foregoing metals; polymers (e.g., thermoset resins); ceramics; glass; composites comprising one or more polymers (e.g., thermoset resins) and fiberglass; quartz; silicon; telflex; or a combination of two or more thereof. The wetted wall material may be in the form of a coating or layer of one of the foregoing materials on the surface of microchannel wall, the coating or layer having a thickness of about 0.1 to about 500 microns, and in one embodiment about 0.1 to about 250 microns, and in one embodiment about 0.1 to about 100 microns, and in one embodiment about 0.1 to about 50 microns, and in one embodiment about 0.1 to about 10 microns. In one embodiment, the interior wall may be partially wetted with intermittent or continuous non-wetted portions. The thin film flowing along the interior wall may have a thickness of about 0.1 to about 500 microns, and in one embodiment about 0.1 to about 250 microns, and in one embodiment about 0.1 to about 150 microns, and in one embodiment about 0.1 to about 75 microns, and in one embodiment about 1 to about 50 microns.

[**0151**] The liquid channels (e.g., **430** and **630**) may comprise microchannels although they may have larger dimensions that would not characterize them as microchannels. Each of these channels may have a cross section that has any configuration, for example, square, rectangular, circular, oval, trapezoidal, etc. Each liquid channel may have an internal dimension of height or width in the range up to about 10 mm, and in one embodiment about 0.05 to about 10 mm, and in one embodiment about 0.05 to about 5 mm, and in one embodiment from about 0.05 to about 2 mm, and in one embodiment from about 0.5 to about 1 mm. The other internal dimension may be in the range from about 1 mm to about 100 mm, and in one embodiment about 5 mm to about 50 mm, and in one embodiment about 10 mm to about 20 mm. The length of the liquid channels may be in the range from about 1 cm to about 200 cm, and in one embodiment about 1 cm to about 50 cm, and in one embodiment about 2 to about 10 cm. The separation between each microchannel (eg., **410**, **610**) and the next adjacent liquid channel (eg.,